security multi-user safe door locks.

BACKGROUND OF THE INVENTION

Banks and certain business establishments have a need for very secure safes. In these circumstances a high security safe may be appropriately accessed by more than one person. Often, repeated access by a number of trusted employees and officers of the institution is required for efficient conduct of the business.

Large high security safe installations are typically set within thick hardened steel vault enclosures that include massive or roller-mounted steel doors. These massive doors often require considerable force to open or close and accordingly, where electrically driven, require significant electrical power to actuate. The lock bolts on deadbolts in the larger safes are massive and require significant power to move. Whatever the large safe vault design, substantial power is required to unlock and open and to close and lock.

Traditionally, safes were unlocked or prepared for access by operation of a mechanical combination lock. The combination for access to the safe was set by a qualified locksmith. Each person with authorized access to the safe would be furnished with the safe lock combination . The authorized person would then commit the operable lock combination to memory for later use.

In the event one of the authorized access persons left employment in the institution, or the access combination was believed compromised, the access combination had to be changed by a locksmith and all authorized persons were

required to learn and memorize a new combination.

It is convenient to have a record identifying which authorized person entered the safe and the time of his or her entry. The mechanical combination lock with shared multi person access makes it difficult to create or maintain accurate records of access events.

The appearance of secure electronic locks is a relatively recent development. Many electronic locks have been described in the patent literature, each of these earlier lock systems have been devised to provide one or more improved features such as recording each access event or, for example, providing less expensive change in the access code. However, none of these earlier electronic lock systems have been applicable to the unique set of high security yet convenient multiple person authorized access desired in larger high security safe vault installations.

SUMMARY OF THE INVENTION

The invention is comprised of multistage means for identifying and determining the authorization of a person attempting to enter a large safe entry barrier. The multiple stages include an access card means furnished each authorized person, access card reader and keypad digital signal input means. A first microprocessor, the access card signal being entered into the first microprocessor. A control microprocessor, the keypad digital signal being entered into the control microprocessor. The first and control microprocessors having Read Only Memories (ROM) into which authorized identification codes are entered upon which identification codes may be matched or, if

not matched, the access will be denied. Solenoid operated dead bolt locks are mounted upon the safe entry barrier. A source of high voltage DC electric power, electrical switch means for energizing the deadbolt solenoid to alternately assume an open position or a closed position by connecting the higher voltage DC electrical power source through the switch. The digital signal input derived from the control microprocessor provides information to control the switch means, whereby a massive safe solenoid lock may be operated while maintaining high security protocol.

OBJECTS OF THE INVENTION

A first object of the present invention is to provide a highly secure electronic lock system having sufficient power adapted to unlocking and opening or securely locking a safe vault door having movable dead lock bolts.

Another object of my invention is to provide an electronic system for secure authorized multi-person user access to a safe installation.

Another object of my invention is to provide an electronic system utilizing both an access card and a numerical Personal Identification Number wherein the secure lock system actuates using sufficient augmented electric power a solenoid-controlled deadbolt access control barrier to a safe installation.

Still another object of my invention is to provide an electronic secure lock system which provides inexpensive and readily executed changes in access codes for one or more of several authorized persons wherein such access code changes require no extensive mechanical safe lock adjustments.

Yet another object of my invention is to provide an electronic safe lock system for authorized access having means to provide sufficient electric power for large safe installations wherein the identity of the person and time of his or her authorized access is unambiguously recorded.

Other objects and advantages of the invention will be apparent from the following illustrations, specification, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a diagram showing the component parts of a preferred embodiment of my invention.

Fig. 2 is a flow chart showing the flow of information during operation of the preferred embodiment of my invention illustrated in Fig. 1.

Fig. 3 illustrates a variation of the preferred embodiment shown in Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig.1, which shows a schematic block diagram of a preferred embodiment of the invention, code sensor 200 is adapted to read numerical data encoded on the magnetic strip of a plastic access card. When a such an access card is swiped through the reader of code sensor 200, numerical data are transmitted to first microprocessor 210 which has a read-only memory (ROM), in which are contained allow access codes. If no match between the transmitted data and an access code is found, the program terminates and the display reads "access denied", while a match

results in a display prompt reading "enter PIN". When a PIN is entered by means of a keypad 220, the entered data is transmitted to a control microprocessor 230 having a read-only memory (ROM) that compares the inputted PIN to a list of allowed PINS. NO match results in termination of the program and a display prompt reading "access denied", while a match results in a display prompt such as "enter instruction code that requests a numerical code that will specific one or two electronic messages that result in sending a signal in the form of a 3 V pulse that passes through a voltage step up relay240, into which 120 V AC flows after passing through an AC to DC converter, and then to either the deadbolt open solenoid 260 or the deadbolt close solenoid 270 that together control the deadbolt entry barrier. A 15 V DC battery 250 operates as a stand-by source of power in the event it is needed to actuate the solenoid should the AC source fail.

Referring now to Fig.2, which shows the flow of information during operation of the preferred embodiment, access code sensor 200 reads data contained on an access card and transmits it to first microprocessor 210, where it is compared to allow codes stored in the ROM. A match prompts the user to enter a numerical PIN using keypad 220. The inputted PIN is transmitted to a control microprocessor 230 which records the inputted PIN and the time of the attempted entry and compares the inputted PIN to a list of ROM-stored allowed access PINs to determine whether a match exists. If a match exists, the display prompts the access seeker to enter numerical instructions. The input of a numerical instruction code results in a 3V signal being sent from the control microprocessor 230. This 3V signal is then amplified by 120V AC current passing through an AC to DC converter 245 to yield a 15V pulse which then actuates

either the open solenoid or the close solenoid depending upon which numerical message had been inputted.

Referring to Fig. 3 which shows a second embodiment of the invention that utilizes a spring loaded solenoid deadbolt access barrier, access card reader 10 and keypad 20 are combined in a wall amount unit 5. Display 30 instructs an access seeker to swipe an access card through access card reader 10. Upon swiping the card, the access code recorded on the card is transmitted to a first microprocessor 40 which compares it a list of ROM-stored access codes. If no match is detected, the program is terminated and the display 30 will read "access denied". If a match is detected, the display 30 instructs the access seeker to input a numerical PIN using keypad 20. The PIN is transmitted to a control microprocessor 50, having a Read Only Memory (ROM) in which are stored authorized PINs. The inputted PIN is compared to the authorized PINs, and if no match is found, the program is terminated and display 30 will read "access denied." If a match is found between the inputted PIN and an authorized code, the display 30 will prompt the access seeker to give further instructions, which may include numerical codes for adjusting the time delay of the spring-loaded, solenoid controlled deadbolt barrier 60. A 3 volt pulse is then sent from control microprocessor 50 to voltage step-up relay 70 where it is amplified, perhaps by using an AC standby battery. Voltage step up relay then sends a 15 volt DC current to solenoid 80, which results in opening the deadbolt barrier 60 and compressing a spring 90. The deadbolt barrier 60 stays open until the period of the time delay expires. Following the expiration of the time delay, the spring is 90 released, closing deadbolt access barrier 60.